

**Total Ionizing Dose Test:
SG1644 Dual High-Speed Driver (Linfinity).**

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Report Date: 02/01/06

1. Introduction

A radiation evaluation was performed on the SG1644 Dual High-Speed Driver from Linfinity. The test was conducted in November 2005.

2. Part Information

Table I contains the part information and Fig. 1 depicts the pin-out for the LCC package.

**Table I.
Part Information**

| | |
|---|---|
| Generic Part Number: | SG1644 |
| Full Part Number: | SG5962-9165301M2A |
| Manufacturer: | Linfinity |
| Lot Date Code (LDC): | 0432 |
| Quantity Tested: | 6 |
| Serial Numbers of Control Sample: | 6 |
| Serial Numbers of Radiation Samples: | 1, 2, 3, 4, and 5 |
| Part Function: | Dual High-Speed Driver |
| Part Technology: | Bipolar |
| Package Style: | LCC (20 pin) |
| Test Equipment: | Parametric analyzer, power supply |
| Test Engineer: | J. Forney |
| Case markings: | SG5962- 9165301M2A D34333 PHIL 1C0432P Q |

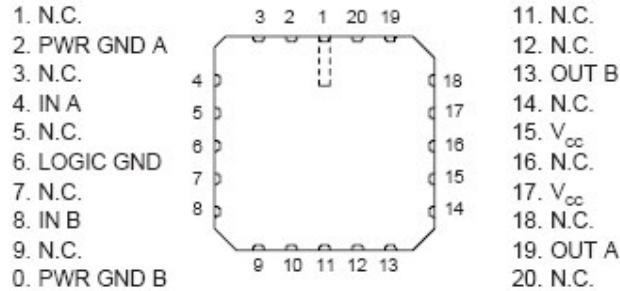


Fig. 1. Pin-out for the SG1644.

3. Test Method

The total dose testing was performed using the NASA/GSFC Co⁶⁰ gamma ray source. Five parts were irradiated under bias. In the chosen bias configuration, 10 V was applied to V_{dd}, all the inputs were grounded, and the outputs were floating. There was one control sample. The total dose radiation levels were 1, 5, 10, 20, 40, 75 and 100 krad(Si). The target dose rate was approximately 100 Rad(Si)/s. A parametric analyzer was used to do the measurements.

Initial electrical measurements were made on 6 samples. Only one channel in each part was tested. After each radiation exposure, parts were electrically tested to determine if there were any changes in parametric values. All parts passed all parametric measurements up to 100 krad(Si). Post radiation annealing was done by leaving the devices for a week at room temperature under 10 V bias.

Table II lists the parametric values that were monitored following each exposure level.

Table II.
SG1644 Parametric Characteristics.

| Parameter | Condition | MIN | MAX | Units |
|---|-------------------------------|--------------------|------|-------|
| Output High Voltage (V _{OH}) | 10 V < V _{cc} < 20 V | V _{CC} -3 | | V |
| Output Low Voltage (V _{OL}) | 10 V < V _{cc} < 20 V | | 1 | V |
| Input High Current (I _{IH}) | V _{IN} = 2.4 V | | 500 | µA |
| Input Low Current (I _{IL}) | V _{IN} = 0 V | | -4.0 | mA |
| Supply Current Low (I _{CCL}) | V _{IN} = 2.4 V | | 27 | mA |
| Supply Current High (I _{CCH}) | V _{IN} = 0 V | | 12 | mA |

4. Results

The results of the parametric measurements are listed in the following tables:

Table III
V_{out_high} (V) as a Function of Total Dose
(Min. = V_{cc}-3V = 7V)

| TID | DUT1 | DUT2 | DUT3 | DUT4 | DUT5 | Control | Average | St. Dev. |
|--------------------|------|------|------|------|------|---------|---------|----------|
| 0 | 9.54 | 9.51 | 9.54 | 9.61 | 9.56 | 9.59 | 9.55 | 0.03 |
| 1 | 9.55 | 9.53 | 9.57 | 9.63 | 9.57 | 9.61 | 9.57 | 0.04 |
| 5 | 9.56 | 9.52 | 9.56 | 9.63 | 9.57 | 9.61 | 9.57 | 0.04 |
| 10 | 9.55 | 9.53 | 9.56 | 9.63 | 9.57 | 9.61 | 9.57 | 0.04 |
| 20 | 9.55 | 9.52 | 9.54 | 9.61 | 9.55 | 9.59 | 9.55 | 0.03 |
| 40 | 9.53 | 9.51 | 9.53 | 9.59 | 9.54 | 9.59 | 9.54 | 0.03 |
| 75 | 9.53 | 9.50 | 9.53 | 9.59 | 9.54 | 9.60 | 9.54 | 0.03 |
| 100 | 9.52 | 9.51 | 9.53 | 9.60 | 9.54 | 9.59 | 9.54 | 0.03 |
| Post Anneal | 9.51 | 9.52 | 9.54 | 9.61 | 9.56 | 9.60 | 9.55 | 0.04 |

Table IV
V_{out_low} (V) as a Function of Total Dose
(Max. = 1 V)

| TID | DUT1 | DUT2 | DUT3 | DUT4 | DUT5 | Control | Average | St. Dev. |
|--------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| 0 | 5.36E-02 | 8.23E-02 | 7.22E-02 | 4.09E-02 | 5.38E-02 | 5.09E-02 | 6.05E-02 | 1.65E-02 |
| 1 | 5.38E-02 | 8.04E-02 | 7.06E-02 | 4.10E-02 | 5.34E-02 | 5.05E-02 | 5.98E-02 | 1.56E-02 |
| 5 | 5.38E-02 | 8.18E-02 | 7.27E-02 | 4.12E-02 | 5.36E-02 | 5.07E-02 | 6.06E-02 | 1.63E-02 |
| 10 | 5.46E-02 | 8.28E-02 | 7.33E-02 | 4.17E-02 | 5.42E-02 | 5.05E-02 | 6.13E-02 | 1.65E-02 |
| 20 | 5.29E-02 | 8.16E-02 | 7.20E-02 | 4.10E-02 | 5.35E-02 | 5.03E-02 | 6.02E-02 | 1.63E-02 |
| 40 | 5.43E-02 | 8.27E-02 | 7.32E-02 | 4.21E-02 | 5.46E-02 | 5.07E-02 | 6.14E-02 | 1.63E-02 |
| 75 | 5.44E-02 | 8.25E-02 | 7.32E-02 | 4.13E-02 | 5.40E-02 | 5.00E-02 | 6.11E-02 | 1.65E-02 |
| 100 | 5.44E-02 | 7.99E-02 | 7.20E-02 | 4.02E-02 | 5.45E-02 | 5.00E-02 | 6.02E-02 | 1.58E-02 |
| Post Anneal | 5.51E-02 | 8.21E-02 | 7.28E-02 | 4.17E-02 | 5.41E-02 | 5.02E-02 | 6.12E-02 | 1.61E-02 |

Table V
Input High Current (A) as a Function of Total Dose
(Max. = 500 μA)

| TID | DUT1 | DUT2 | DUT3 | DUT4 | DUT5 | Control | Average | St. Dev. |
|--------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| 0 | 2.30E-05 | 5.28E-06 | 1.14E-05 | 4.53E-05 | 1.93E-05 | 1.69E-05 | 2.08E-05 | 1.53E-05 |
| 1 | 2.28E-05 | 5.90E-06 | 1.24E-05 | 4.53E-05 | 1.97E-05 | 1.74E-05 | 2.12E-05 | 1.50E-05 |
| 5 | 2.26E-05 | 5.40E-06 | 1.10E-05 | 4.48E-05 | 1.93E-05 | 1.71E-05 | 2.06E-05 | 1.51E-05 |
| 10 | 2.18E-05 | 5.09E-06 | 1.07E-05 | 4.38E-05 | 1.88E-05 | 1.72E-05 | 2.00E-05 | 1.48E-05 |
| 20 | 2.35E-05 | 5.44E-06 | 1.13E-05 | 4.49E-05 | 1.93E-05 | 1.74E-05 | 2.09E-05 | 1.51E-05 |
| 40 | 2.20E-05 | 5.09E-06 | 1.07E-05 | 4.28E-05 | 1.83E-05 | 1.69E-05 | 1.98E-05 | 1.44E-05 |
| 75 | 2.17E-05 | 5.15E-06 | 1.07E-05 | 4.38E-05 | 1.88E-05 | 1.75E-05 | 2.00E-05 | 1.48E-05 |
| 100 | 2.18E-05 | 5.95E-06 | 1.13E-05 | 4.59E-05 | 1.84E-05 | 1.75E-05 | 2.07E-05 | 1.54E-05 |
| Post Anneal | 2.02E-05 | 5.26E-06 | 1.09E-05 | 4.35E-05 | 1.87E-05 | 1.73E-05 | 1.97E-05 | 1.46E-05 |

Table VI
Input Low Current (A) as a Function of Total Dose
(Max. = -4 mA)

| TID | DUT1 | DUT2 | DUT3 | DUT4 | DUT5 | Control | Average | St. Dev. |
|--------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-----------------|
| 0 | -9.28E-04 | -9.42E-04 | -9.17E-04 | -9.01E-04 | -9.23E-04 | -9.31E-04 | -9.22E-04 | 1.52E-05 |
| 1 | -9.29E-04 | -9.40E-04 | -9.15E-04 | -9.01E-04 | -9.22E-04 | -9.30E-04 | -9.21E-04 | 1.47E-05 |
| 5 | -9.29E-04 | -9.41E-04 | -9.18E-04 | -9.01E-04 | -9.22E-04 | -9.31E-04 | -9.22E-04 | 1.46E-05 |
| 10 | -9.30E-04 | -9.42E-04 | -9.18E-04 | -9.03E-04 | -9.23E-04 | -9.31E-04 | -9.23E-04 | 1.45E-05 |
| 20 | -9.25E-04 | -9.39E-04 | -9.15E-04 | -9.00E-04 | -9.21E-04 | -9.30E-04 | -9.20E-04 | 1.42E-05 |
| 40 | -9.28E-04 | -9.40E-04 | -9.16E-04 | -9.04E-04 | -9.23E-04 | -9.31E-04 | -9.22E-04 | 1.33E-05 |
| 75 | -9.29E-04 | -9.39E-04 | -9.15E-04 | -9.03E-04 | -9.22E-04 | -9.29E-04 | -9.22E-04 | 1.34E-05 |
| 100 | -9.29E-04 | -9.35E-04 | -9.13E-04 | -9.00E-04 | -9.22E-04 | -9.29E-04 | -9.20E-04 | 1.36E-05 |
| Post Anneal | -9.31E-04 | -9.37E-04 | -9.13E-04 | -9.02E-04 | -9.20E-04 | -9.30E-04 | -9.21E-04 | 1.39E-05 |

Table VII
Supply Currents (A) with Outputs Low as a Function of Total Dose
(Max. = 27 mA)

| TID | DUT1 | DUT2 | DUT3 | DUT4 | DUT5 | Control | Average | St. Dev. |
|--------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 0 | 3.25E-03 | 3.21E-03 | 3.15E-03 | 3.26E-03 | 3.23E-03 | 3.24E-03 | 3.22E-03 | 4.53E-05 |
| 1 | 3.25E-03 | 3.20E-03 | 3.14E-03 | 3.26E-03 | 3.23E-03 | 3.24E-03 | 3.22E-03 | 4.79E-05 |
| 5 | 3.24E-03 | 3.20E-03 | 3.14E-03 | 3.25E-03 | 3.22E-03 | 3.24E-03 | 3.21E-03 | 4.45E-05 |
| 10 | 3.24E-03 | 3.19E-03 | 3.13E-03 | 3.25E-03 | 3.21E-03 | 3.24E-03 | 3.20E-03 | 4.45E-05 |
| 20 | 3.22E-03 | 3.18E-03 | 3.12E-03 | 3.23E-03 | 3.20E-03 | 3.24E-03 | 3.19E-03 | 4.39E-05 |
| 40 | 3.21E-03 | 3.17E-03 | 3.11E-03 | 3.23E-03 | 3.19E-03 | 3.24E-03 | 3.18E-03 | 4.39E-05 |
| 75 | 3.20E-03 | 3.16E-03 | 3.10E-03 | 3.21E-03 | 3.18E-03 | 3.23E-03 | 3.17E-03 | 4.26E-05 |
| 100 | 3.19E-03 | 3.15E-03 | 3.09E-03 | 3.20E-03 | 3.17E-03 | 3.23E-03 | 3.16E-03 | 4.32E-05 |
| Post Anneal | 3.19E-03 | 3.15E-03 | 3.10E-03 | 3.21E-03 | 3.17E-03 | 3.23E-03 | 3.16E-03 | 4.24E-05 |

Table VIII
Supply Currents (A) with Outputs High as a Function of Total Dose
(Max. = 12 mA)

| TID | DUT1 | DUT2 | DUT3 | DUT4 | DUT5 | Control | Average | St. Dev. |
|--------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 0 | 5.36E-03 | 5.43E-03 | 5.29E-03 | 5.52E-03 | 5.50E-03 | 5.47E-03 | 5.42E-03 | 9.49E-05 |
| 1 | 5.38E-03 | 5.41E-03 | 5.28E-03 | 5.52E-03 | 5.50E-03 | 5.47E-03 | 5.42E-03 | 9.54E-05 |
| 5 | 5.38E-03 | 5.42E-03 | 5.29E-03 | 5.51E-03 | 5.49E-03 | 5.47E-03 | 5.42E-03 | 8.95E-05 |
| 10 | 5.46E-03 | 5.41E-03 | 5.28E-03 | 5.51E-03 | 5.49E-03 | 5.47E-03 | 5.43E-03 | 8.87E-05 |
| 20 | 5.29E-03 | 5.40E-03 | 5.27E-03 | 5.49E-03 | 5.47E-03 | 5.47E-03 | 5.38E-03 | 1.02E-04 |
| 40 | 5.43E-03 | 5.39E-03 | 5.26E-03 | 5.49E-03 | 5.46E-03 | 5.47E-03 | 5.41E-03 | 8.79E-05 |
| 75 | 5.44E-03 | 5.38E-03 | 5.24E-03 | 5.47E-03 | 5.44E-03 | 5.47E-03 | 5.39E-03 | 9.08E-05 |
| 100 | 5.44E-03 | 5.35E-03 | 5.23E-03 | 5.45E-03 | 5.44E-03 | 5.47E-03 | 5.38E-03 | 9.45E-05 |
| Post Anneal | 5.45E-03 | 5.37E-03 | 5.24E-03 | 5.46E-03 | 5.44E-03 | 5.47E-03 | 5.39E-03 | 9.25E-05 |

5. Conclusion

All parts passed all parametric tests up to 100 krad(Si).